

Application No. 10/678,045
Reply dated August 17, 2005
Response to Office Action dated May 17, 2005

REMARKS

Favorable consideration and allowance are respectfully requested for claims 1-11 in view of the foregoing amendments and the following remarks.

The title is amended to recite “Method of Removing Oxide Film on a Substrate with Hydrogen and Fluorine Radicals” in accordance with the Examiner’s kind suggestion to amend the title.

The rejection of claim 1 under 35 U.S.C. § 102 as anticipated by Jimbo et al. (US Patent No. 5,756,402) is respectfully traversed.

Claim 1 is amended so that it is directed to “a method of removing an oxide film on a surface of substrate,” and the limitations of claims 6 and 8 are incorporated therein. The phrase “in parallel” is used instead of “simultaneously” in order to clarify what is claimed. Claim 1 recites “removing the oxide film by processing the surface of the substrate with the hydrogen radicals and the fluorine radicals wherein the step of providing hydrogen radicals and the step of providing fluorine radicals are performed in parallel and the step of providing hydrogen radicals is terminated after the step of providing fluorine radicals is terminated.” Support for these amendments may be found in the claims as well as on page 3 of the specification which recites “removing native oxide” on line 26.

Jimbo discloses two methods of selectively etching a silicon nitride film (Si_3N_4). The first method (example 1) uses fluorine radicals, oxygen radicals, and H_2O (not in plasma state) (column 4, lines 42-43, 59-60). The second method (example 2) uses fluorine radicals, oxygen radicals, and hydrogen radicals (H_2O in plasma state) (column 9, lines 43-44).

Jimbo does not teach a method of removing an oxide film on a surface of a substrate, and do not disclose at least the following features of claim 1: “removing the oxide film by processing the surface of the substrate with the hydrogen radicals and the fluorine radicals”; and that “the step of providing hydrogen radicals is terminated after the step of providing fluorine radicals is terminated.”

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Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

The rejection of claims 1 and 2 under 35 U.S.C. § 102 as anticipated by Kanai et al. (US Patent No. 5,007,971) is respectfully traversed.

Kanai discloses a method of forming a pin heterojunction photovoltaic element, at least the n -type or p-type semiconductor layer of which comprises an n-type or p-type polycrystal BP:H(F) semiconductor film which exhibits a high photoelectric conversion efficiency (column 1, lines 10-15).

Kanai does not teach a method of removing an oxide film on a surface of a substrate, and do not disclose at least the following features of claim 1: “removing the oxide film by processing the surface of the substrate with the hydrogen radicals and the fluorine radicals”; and that “the step of providing hydrogen radicals is terminated after the step of providing fluorine radicals is terminated.”

Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

The rejections of claims 2-11 under 35 U.S.C. § 103 as obvious over Jimbo et al. and the rejection of claims 3-11 as obvious over Kannai et al. are respectfully traversed.

Claims 6 and 8 are deleted, without prejudice or any disclaimer of the subject matter therein.

Claims 2-5 and 7 all depend from claim 1 and include all of the limitations thereof. As indicated above, claim 1 is amended to include the limitations of previously-pending claims 6 and 8. The present record includes no indication that one of skill in the art would find any teaching, suggestion or motivation to try to modify the method of Jimbo or Kannai so as to arrive at the presently claimed invention. The Office Action includes the conclusory assertion that “determination of optimum values of cause effective variables such as these process parameters including different injection times is within the skill of one practicing in the art.” The Office Action includes no support for this conclusion that changing the timing

of the different steps is simply optimizing values of cause effective variable. The present record also does not show that a person of skill in the art would know that manipulating the timing of the various steps would be at all result-effective. Absent persuasive evidence showing a person of skill in the art would know to modified these variables, the claims are not obvious. Further, there must be some suggestion or motivation for a person of skill in the art to try to modify these variables. There is no such motivation shown in the present record and therefore, the obviousness rejection cannot be properly maintained.

Moreover, as described in the specification, for instance on page 13, where the hydrogen radicals are provided even after the fluorine is stopped, the absorption of fluorine on the surface of the substrate is minimized. Thus, the timing of the different steps is outcome determinative and critical to the process. On the present record, there is no indication of how or why one of skill in the art would believe that it might be advantageous to try to minimize fluorine absorption on the surface of the substrate much less how one might try to achieve this goal.

Claim 9 is amended to make it independent so that it is directed to “a method of removing an oxide film on a surface of substrate,” and comprises “providing water vapor to the surface of the substrate; and removing the oxide film by processing the surface of the substrate with the hydrogen radicals and the fluorine radicals.” As indicated above, neither Jimbo nor Kannai teach removing an oxide film on a surface of a substrate.

Similarly, neither reference teaches at least the following features of claim 9: a method involving “providing water vapor to the surface of the substrate and removing the oxide film by processing the surface of the substrate with the hydrogen radicals and the fluorine radicals.”

Claims 10 and 11 depend from claim 9 (ultimately) and further limit the method thereof. Jimbo does not appear to teach the steps therein, especially that of claim 10 with steps of (i) providing hydrogen radicals and fluorine radicals in parallel and (ii) providing water vapor where steps (i) and (ii) are performed alternately and repeatedly.

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Accordingly, the cited references fails to teach each and every element of the claimed invention and reconsideration and withdrawal thereof are respectfully requested.

CONCLUSION

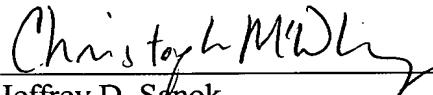
In view of the foregoing, the application is respectfully submitted to be in condition for allowance, and prompt favorable action thereon is earnestly solicited.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #010986.52822US).

Respectfully submitted,

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